MARINE UPPER CRETACEOUS AND A NEW ECHINOCORYS FROM THE ALTAPLANICIE OF BOLIVIA[1]

EDWARD W. BERRY
Johns Hopkins University, Baltimore

It is not surprising that rocks of Upper Cretaceous age should be present on the high plateau of Bolivia since the gypsiferous shallow water phase of the Upper Cretaceous which represents the several typically developed marine horizons that are so abundantly represented in the more northern parts of the Andean geosyncline (e.g., in central Peru), is conspicuous in the Eastern Andes of Bolivia and furnished the writer with marine fossils at two localities in the Department of Potosí.

It may be true also that these marginal Upper Cretaceous deposits of Bolivia, which are essentially reddish sandstones and gypsiferous shales, with subordinate beds of limestone, are present in considerable amount beneath the late Tertiary and more recent deposits that make up most of the surface of the high plateau except where older rocks are folded and project through these thick, surficial deposits.

No Cretaceous rocks have heretofore been known from the Altaplanicie, however, although it is true that Steinmann called the rocks at Corocoro Cretaceous. This was based solely on the fact that the Corocoro rocks were red, and as the red rocks near Potosí, 375 km. distant, were known to be Cretaceous, the unwarranted assumption was made that the Corocoro rocks also were Cretaceous. Many have followed Steinmann's opinion, as, for example Douglas in his recent geological sections across the Andes,[2] although it would seem that if color is to be an age criterion, an Englishman would consider red as indicative of Old Red or New Red age, as did Forbes in his classic studies of Bolivian Geology.

[1] *George Huntington Williams Memorial Publication No. 9.*

[2] J. A. Douglas, *Quart. Jour. Geol. Soc. Lond.*, Vol. LXXVII (1914), pp. 1–53; Vol. LXX (1920), pp. 1–61; Vol. LXXVII (1921), pp. 246–84.

As a matter of fact the writer showed in 1917 that the Corocoro rocks were of Pliocene age[1] and this age determination is fully and completely established by detailed field studies made by Singewald and Berry in 1919, the results of which are now awaiting publication.[2]

The presence of true Upper Cretaceous in this region rests on the species of Echinocorys or Ananychites described below (Figs. 1–3), for which I am indebted to Señor Arturo Poznansky, of La Paz. It is said to have been collected at Peñas, which is just east of the southern end of Lake Titicaca in the Department of La Paz, and 55 km. northwest of the city of that name. It was not possible for me to visit the locality, but there is no reason for doubting its correctness since the specimen was newly collected at the time of my visit to La Paz and must have come from the near vicinity of the place named.

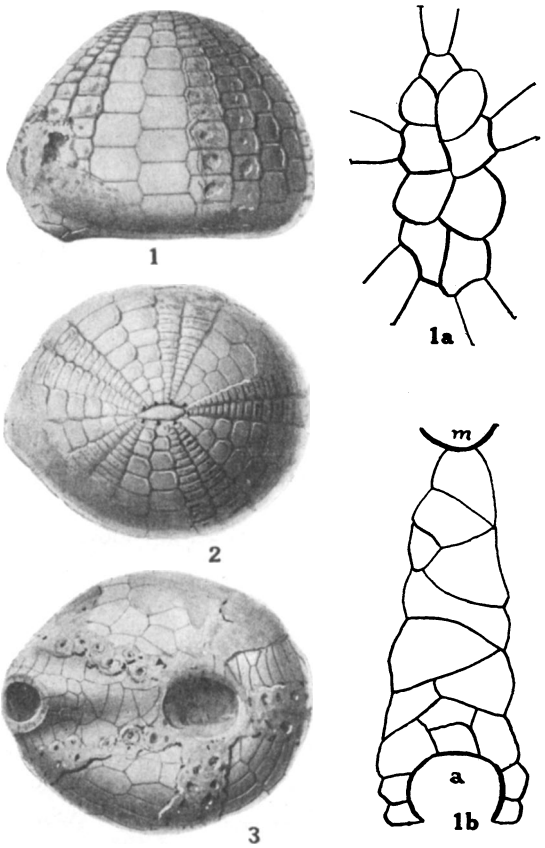
The specimen in itself is of great interest since it is, to the best of my knowledge, the first specimen of this interesting genus, so excessively abundant in the Upper Cretaceous of Europe, to be recorded from South America, and the third or fourth to be recorded from the Western Hemisphere. It does not agree with any of the numerous described species and may be called in honor of its progressive collector *Echinocorys* (*Ananychites*) *poznanskii* sp. nov.

It may be described as follows: Ambital outline elliptical, rounded in front and somewhat narrowed behind. Profile (i.e., transverse section) subcircular, the apex broadly rounded. Peristome elliptical 7 mm. in length by 10 mm. in width, situated about two-fifths back from the anterior margin, hence relatively larger and slightly more posterior in position than is commonly the case in this genus. Periproct posterior, subambital in position, large, elliptical in form, with a length of 8 mm. and a width of 6 mm. The apical system is largely obscured by calcitic incrustations. As near as it can be made out it consists of four larger genitals and five smaller oculars arranged as indicated in the accompanying sketch (Fig. 1*a*). The plastron appears to have been smooth and to comprise the sixteen plates shown in the accompanying sketch (Fig. 1*b*), and is unusual,

[1] E. W. Berry, *U.S. Nat. Mus. Proc.*, Vol. LIV (1917), pp. 103–64.

[2] Singewald and Berry, *Bull. Geol. Soc. Am.*, Vol. XXXII (1921), p. 66 (abstract).

if my interpretation is correct, in having a posterior pair of plates occluded, as indicated. Centrally the plastron becomes increasingly convex toward the periproct in which region it projects about 3 mm. below the oral plane of the test. The abulacral plates number



FIGS. 1–3.—*Echinocorys* (*Ananychites*) *poznanskii* sp. nov. 1, lateral view; 1*a*, sketch of arrangement of apical system; 1*b*, sketch of plastron, comprising sixteen plates; 2, dorsal view; 3, ventral view.

eighteen or nineteen normal pairs from the apex to the ambitus, very small at first and increasing regularly and rapidly in size downward. The pores are very much obscured by incrustation, the pore pairs being clearly seen only toward the equatorial region, where they are large and central in position, that is, some distance

within the outer margins of the ambulacrals. The inter-abulacrals are larger and there are ten normal pairs between the apex and the ambitus. Length of the type 5.1 cm.; width 4.25 cm.; height 3.95 cm.

These interesting and characteristic echinoids were figured as early as 1565 and are a striking element in the later Upper Cretaceous faunas of Europe. They appear somewhat abruptly in the Turonian, undergo but slight diversification in the Santonian, and become exceedingly abundant and diversified in the Campanian. They have dwindled to two known forms in the Maestrichtian and have a single Danian and a single Eocene survivor. They evidently found their optimum environment in the relatively clear and shallow waters in which the chalk was deposited, which may account for their singular rarity in the North American Upper Cretaceous where such a large proportion of the sediments are muddy, thus offering obstacles to both migration and colonization. In keeping with this theory there is a single small species known from the Vincentown lime sands of the Rancocas formation of New Jersey, *Ananchytes ovalis* Clark[1], and a second large species, *Ananychites texana* Cragin[2], from the Austin and Annona chalk in Texas and Arkansas. Both are exceedingly rare and, so far as I know, are represented by only the type specimens. The Rancocas formation was considered to be of Danian age by Clark[3] although it is probably Maestrichtian, and the Austin chalk should probably be correlated with the Santonian or Campanian substages of Europe. A single additional record of the genus in North America is an incidental and queried reference by Aquilera[4] to the presence of *Ananchytes sulcatus* Goldfuss in the Upper Cretaceous of Mexico.

Lambert's excellent monograph[5] of the genus renders comparisons easy and this new Bolivian species is seen to somewhat resemble

[1] W. B. Clark, *U.S. Geol. Survey Bull. 97* (1893), p. 74, Pl. XXXVI, Fig. 1 *a–h*.

[2] F. W. Cragin, *Fourth Ann. Rept. Geol. Surv. Texas* (1893), p. 145, Pl. XXV, Fig. 12; Pl. XXVI, Figs. 1, 2.

[3] W. B. Clark, *Geol. Soc. Am. Bull.*, Vol. VIII (1897), pp. 315–58.

[4] J. G. Aquilera and E. Ordoñez, *Datos para la geologio de México* (1893), p. 27.

[5] J. Lambert, "Étude monographique sur le Genre Echinocorys," *Mem. Mus. Roy. d. Hist. Nat. Bèlge*, Tome 2 (1903).

the European Danian species, *E. sulcatus* Goldfuss, but it appears to be most similar to the European Campanian and Maestrichtian forms, *E. Cotteaui* and *E. Duponti*, described by Lambert, who prefers to use the generic term *Echinocorys* proposed in pre-Linnean time (1732) by Breynius, and re-adopted in 1778 by Leske, rather than *Ananchites* Lamarck (1801) which has been adopted in recent American texts. The age of the Bolivian deposit would appear to be Campanian, although more definite confirmation is desirable before this correlation can be accepted as final.